discharge, with the result that he has already increased the amount of combination to 10 per cent. of the total amount of air employed. The air is exposed under increased pressure to a series of parallel spark discharges in the same tube. The change of atmosphere is not made continuously, but intermittently, and the gases are expelled from the discharge tube into a large absorption vessel in which the products are absorbed in a solution of water, or of a caustic alkali. Detailed accounts are given in the memoir of the efficacy of the various forms of high tension discharge, and Dr. V. Lepel is now experimenting with the discharge from a Töpler influence machine with sixty-six rotating plates. Of particular interest are his remarks concerning the probable effect of the high voltage discharges of which we have lately heard so much. He considers it not improbable that by their aid a new mode of producing nitric acid from the atmospheric gases on the large scale may be introduced, rendering us altogether independent of the natural nitrates as a source of nitric acid.

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus*) from North Borneo, presented by the Rev. Augustus D. Beaufort; two Small Hill Mynahs (*Gracula religiosa*) from India, presented by Lieut.-Col. W. S. Hore; a Chough (*Pyrrhocorax graculus*) from the Aran Islands, Galway, presented by Miss Balfour; four Sœmmerring's Pheasants (*Phasianus sœmmerringi* ♂ ♂ ♀ ♀) from Japan, presented by Mr. Frank Walkinshaw; an Æsculapian Snake (*Coluber æsculapii*), a Vivacious Snake (*Tachymenis vivax*) from Central Europe, presented by Mr. Alfred Scrivener; a Cayenne Lapwing (*Vanellus cayennensis*) from South America, two Axolotls (*Siredon mexicanus*) from Mexico, purchased; a Ruddy-headed Goose (*Bernicla rubidiceps* ♀) from the Falkland Islands, received in exchange; a Burchell's Zebra (*Equus burchellii* ♂); a Thar (*Capra jemlaica*), a Japanese Deer (*Cervus sika*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

VARIABLE NEBULÆ.—Mr. Barnard, in *Astronomische Nachrichten*, No. 3097, mentions the cases of two nebulæ which he supposes must be of a variable type. The first has a diameter of about 1′, and appears rather like a comet, the brightness gradually increasing towards the centre, there being no nucleus. Its position for 1889·0 was R.A. 3h. 56m. 17s., Declination + 69° 30′ 38″. The other nebula was discovered by him in 1888, and was estimated to lie between magnitudes 9 and 10, the stellar nucleus being of the thirteenth magnitude. Subsequent observations made in 1891 showed that this nebula had become considerably fainter (13½ mag.), there being still a faint nucleus visible; its diameter was estimated as ½′, while its position for 1888·0 was R.A. oh. 37m. 55·7s., Decl. − 8° 48′ 6″·5.

VARIATION OF LATITUDE.—Mr. Chandler, toward the latter end of last year, contributed to the *Astronomical Journal* several articles on the variation of terrestrial latitudes, in which the following points were brought out :—(1) This variation is truly terrestrial. (2) The period of revolution, from 1863 to 1885, of the pole of the earth's figure round that of rotation amounted to 427 days in a west to east direction. (3) About the year 1730, the length of this period was a little over a year. (4) The velocity of rotation is slowly diminishing. In the present number (267) of the same journal he brings together evidence to establish some further conclusions at which he has arrived, basing them on a very considerable number of series of observations. The results may be briefly summarized as follows :—(*a*) About 1774 the rate of angular motion of the pole was a maximum with a daily rate of 1″·034, and since that period the decrease has taken place at an accelerating rate. (*b*) If θ be the daily angular motion and T the interval in days from September 18, 1875, the angular velocity of the polar motion may be put in the form

$$\theta = 0''\cdot852 - 0''\cdot000\,009\,8\,T - 0''\cdot000\,000\,000\,132\,T^2,$$

(*c*) The law of the periodic variation may be expressed as follows :—

$$\phi = \phi_0 - 0''\cdot22 \cos [\lambda + (t - T)\theta],$$

where T is the time when the north pole of the earth's figure passes the Greenwich meridian,
E the number of completed revolutions between a given date, t, and the adopted epoch,
θ the daily angular motion,
ϕ the instantaneous value of the latitude of a place,
ϕ_0 the mean latitude,
and λ the longitude of the same place,
the values of T and θ being obtained from the equations—

$$T = 1875 \text{ Sept. } 18\cdot5 + 422^d\cdot56\,E + 1^d\cdot034\,E^2 + 0^d\cdot009\,E^3 + 0^d\,000067\,E^4,$$

$$\theta = \frac{360^\circ}{P},$$

when $P = 423^d\cdot62 + 2^d\cdot0953\,E + 0^d\cdot0274\,E^2 + 0^d\cdot000268\,E^3$.

(*d*) A sensibly constant angular distance between the poles of figure and rotation during the last fifty years has been maintained.

(*e*) By a comparison of absolute and differential determinations the variation is entirely due to zenithal alterations, and not to a simultaneous variation of the zenith and the astronomical pole.

COMPARATIVE SPECTRA OF HIGH AND LOW SUN.—Mr. Edward Stanford has just published five plates, 16¾ × 19⅝ inches, in portfolio form, of Mr. McClean's beautiful comparative photographic spectra of the high and low sun from H to A. The collotype prints have been reproduced from the mounted photographs by the Direct Photo-Engraving Company, and are enlarged about 8½ times from the original negatives. Published simultaneously also are his comparative spectral photographs of the sun and metals, extending from above H to near D. The two series include the platinum and iron-copper groups.

THE CORONOIDAL DISCHARGES.—The discovery of the presence and power of electricity is, comparatively speaking, very modern, and it is only now we are finding out the diversity of results it is capable of producing. The sun being our great source of heat and light, it is only natural that we should suspect him of having a greater quantity of this form of energy in some way or the other, on a scale, of course, very much greater than ours. In a paper read before the National Academy of Sciences, Washington, and published in the June number of the *American Journal of Science*, Mr. M. I. Pupin describes a series of experiments that he has been carrying out with regard to electrical discharges through poor media. The apparatus which he used is fully described, so we will only refer to the plates which illustrate the points he wished to emphasize. The illustrations are from photographs of discharges taken under conditions under which the solar corona is observed, and suggest in a very striking manner the phenomena that are usually observed at these times. In one case, when the vacuum was very poor, the discharge started in the form of four large streamers, together with large jets, their distribution over the whole surface of the sphere being more or less uniform. The appearance of the sphere "reminded me very much of the granular structure of the sun's disk, . . and the very luminous points which appeared from time to time . . . reminded me . . . of the sun's faculæ." Further experiments regarding the rotational motion of the streamers lead him to conclude that two discharge streamers tended to blow each other out, "owing to the motion of the cooler gas between them, this motion being produced by the enormous heating effect of the discharge." The figures shown are very striking indeed, and represent the general appearances of the corona during eclipses with a remarkable degree of accuracy.

GEOGRAPHICAL NOTES.

M. JOSEPH MARTIN, well-known on account of his explorations in North-eastern Siberia, has died at Marghilan while on a journey in Central Asia.

THE Kalahari Desert has been crossed successfully by a "trek" of 150 waggons from the Rustenburg district of the Transvaal, bound for Mossamedes, where an active Boer colony has been established, a large party having embarked at Cape Town to join the overland division. Later reports affirm that

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a Boer republic has been declared in the plateau region of Angola, one of the healthiest parts of tropical Africa.

THE survey of the district surrounding Aden has been completed by the officers of the Survey of India Department after a very arduous campaign. Work was on several occasions almost stopped by sickness, and by the open hostility of the natives.

STIMULATED by the recent discovery of two complete mammoth carcases in the Government of Irkutsk, the St. Petersburg Academy of Sciences has commissioned Prof. Tcherski, of Irkutsk, to proceed to Yakutsk, on the Lena, and thence, accompanied by Cossacks and pack-horses, eastward to the Kolyma Valley, pushing on if possible this summer to Nizhne Kolymsk in 69° N., returning before winter to Sachiversk on the Indigirka, a town situated on the Arctic Circle. The main object of the expedition is to study the drift geology, but collections will be made in all departments of science, including barometric observations, in order to determine the orography of this rarely visited part of Siberia.

Globus announces the formation of a new islet in the Caspian, near Baku, by upheaval. It lies three and a half miles from shore, and measures 175 feet by 100 feet, rising about 20 feet above the water. Its surface is irregular, and composed of blackish-grey and yellow hardened mud.

WITH reference to the note on p. 65 as to the discovery of a new range of mountains in Benin, it is only fair to former travellers in that region to say that the map by the Intelligence Department, although bearing no mountain shading, has marked upon it "Mt. Ara," very near the position where the range seen by Governor Carter is situated.

THE mountaineering expedition, led by Mr. Conway, to attempt the ascent of the loftiest Himalayan summits, has been making excursions from Gilgit and mapping the Bagrot Valley, but bad weather has prevented any very important climbing from being done. A *Times* telegram from Calcutta conveys news of June 8 from Gilgit, from which it appears that the greatest height yet reached is 17,000 feet, one night having been passed at an elevation of 15,600 feet. The party was about to set out for Nagar, *en route* for Askoley, by the Hissar Pass.

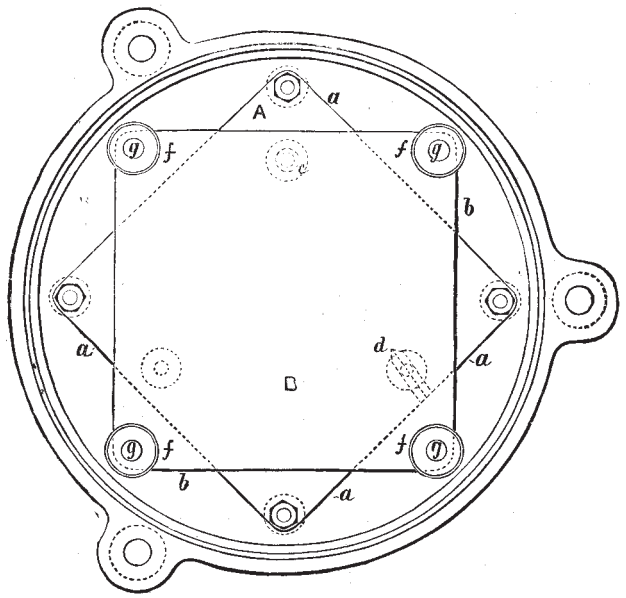
A NEW FORM OF AIR LEYDEN.[1]

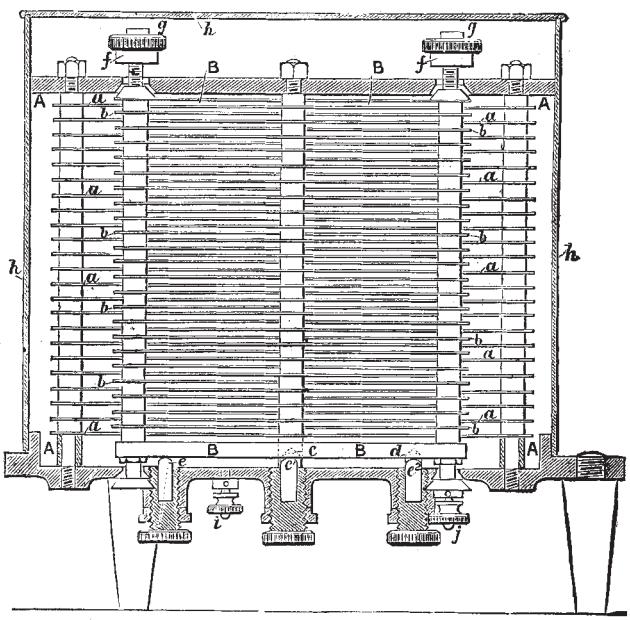
IN the title of this paper as originally offered for communication "*Air Condenser*" stood in place of "*Air Leyden*," but it was accompanied by a request to the Secretaries to help me to a better designation than "Air Condenser" (with its ambiguous suggestion of an apparatus for condensing air), and I was happily answered by Lord Rayleigh with a proposal to use the word "leyden" to denote a generalized Leyden jar, which I have gladly adopted.

The apparatus to be described affords, in conjunction with a suitable electrometer, a convenient means of quickly measuring small electrostatic capacities, such as those of short lengths of cable.

The instrument is formed by two mutually insulated metallic pieces, which we shall call A and B, constituting the two systems of an air condenser, or, as we shall now call it, an air leyden. The systems are composed of parallel plates, each set bound together by four long metal bolts. The two extreme plates of set A are circles of much thicker metal than the rest, which are all squares of thin sheet brass. The set B are all squares, the bottom of which is of much thicker metal than the others, and the plates of this system are one less in number than the plates of system A. The four bolts binding together the plates of each system pass through well-fitted holes in the corners of the squares; and the distance from plate to plate of the same set is regulated by annular distance pieces which are carefully made to fit the bolt, and are made exactly the same in all respects. Each system is bound firmly together by screwing home nuts on the ends of the bolts, and thus the parallelism and rigidity of the entire set is secured.

The two systems are made up together, so that every plate of B is between two plates of A, and every plate of A, except the two end ones, which only present one face to those of the opposite set, is between two plates of B. When the instrument is set up for use, the system B rests by means of the well-known "hole slot and plane arrangement,"[1] engraved on the under side of its bottom plate, on three glass columns which are attached to three metal screws working through the sole plate of system A. These screws can be raised or lowered at pleasure, and by means of a gauge the plates of system B can be adjusted to exactly midway between and parallel to the plates of system





A. The complete leyden stands upon three vulcanite feet attached to the lower side of the sole plate of system A.

In order that the instrument may not be injured in carriage, an arrangement, described as follows, is provided, by which system B can be lifted from off the three glass columns and firmly clamped to the top and bottom plates of system A.

The bolts fixing the corners of the plates of system B are made long enough to pass through wide conical holes cut in the top and bottom plates of system A, and the nuts at the top end of the bolts are also conical in form, while conical nuts are also

[1] "On a New Form of Air Leyden, with Application to the Measurement of Small Electrostatic Capacities." By Lord Kelvin, P.R.S. Read at the Royal Society on June 2.

[1] Thomson and Tait's "Natural Philosophy," § 198 example 3.

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